

# PATENT SPECIFICATION

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## (54) THERMOPLASTIC MOULDING COMPOSITIONS SHOWING ACCELERATED DEGRADATION UNDER THE ACTION OF LIGHT

(71) We, BADISCHE ANILIN- & SODA-FABRIK AKTIENGESELLSCHAFT, a German Joint Stock Company of 6700 Ludwigshafen, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates to thermoplastic moulding compositions of showing accelerated degradation under the action of light and containing (1) a synthetic organic thermoplastic high molecular weight polymeric material (thermoplastic) and (2) a substance which accelerates the degradation of said thermoplastic under the action of light (sensitizer), which sensitizer is present in an amount of from 0.01 to 5% by weight, based on the thermoplastic.

15 Moulding compositions of this kind are well known. The thermoplastics contained therein are generally polymers of styrene, ethylene or propylene, i.e. mass-produced plastics from which disposable articles are made in large quantities, for example sheeting packages. In addition to the thermoplastics, said moulding compositions also contain sensitizers, i.e. substances which accelerate degradation of the thermoplastics under the action of light. Examples of the latter substances are derivatives of  $\gamma$ -pyrone (French Patent 2,060,676).

20 The purpose of the sensitizers is to render articles which have been made from the moulding compositions less of an environmental problem by causing them to disintegrate rapidly after use. However, these sensitizers must usually meet other requirements, for example they should cause no impairment or only minimum impairment of the other properties of the moulding compositions such as their processability and their physical and chemical properties. In many cases, the use of the sensitizers must not

involve any health hazards (e.g. when used for foodstuff packages).

The present invention seeks to provide improved sensitizers for thermoplastic moulding compositions of the type defined above.

We have found that certain anthraquinone derivatives are valuable sensitizers for thermoplastics.

According to the present invention thermoplastic moulding compositions showing accelerated degradation under the action of light comprise (1) a synthetic organic thermoplastic high molecular weight polymeric (thermoplastic) and (2) a substance (sensitizer) which accelerates the degradation of said thermoplastic under the action of light, which sensitizer is present in an amount of from 0.01 to 5% and preferably from 0.1 to 2% by weight, based on the thermoplastic, the moulding compositions of the invention being characterized in that they contain, as sensitizer, a benzoyl aminoanthraquinone or a phthaloyl aminoanthraquinone.

In other words the present invention provides for the use of a benzoyl aminoanthraquinone or phthaloyl aminoanthraquinone as sensitizer in moulding compositions of the type defined above.

Conventional polymers, polyadducts and polycondensates are suitable as thermoplastics for the purpose of the present invention. As examples there may be mentioned olefin, styrene and vinyl chloride polymers, polylactams, polyurethanes, polyesters and polyamides. Preferred thermoplastics are homopolymers and copolymers containing ethylene, propylene, butene-1, 4-methylpentene-1 or styrene as the sole or main monomer, these products also including polystyrenes or styrene polymers which have been modified to improve their impact resistance. The best results are obtained with a polyethylene, polypropylene or polybutene-1. Suitable thermoplastics for the purpose of the present invention are commercially avail-

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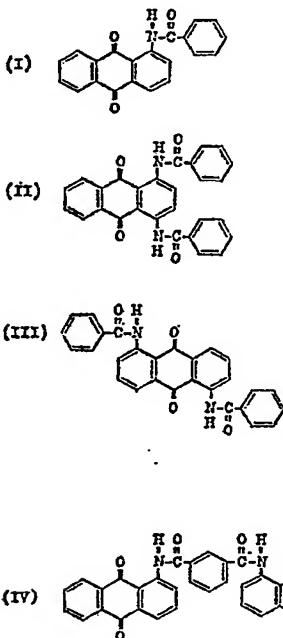
able in great variety and it is therefore unnecessary to describe them in detail in this specification. However, it may be mentioned that the said thermoplastics may contain conventional auxiliaries or additives, for example foaming agents for the production of foamed products, lubricants, stabilizers, pigments and dyes. If the thermoplastics also contain light stabilizers, these generally have a certain counteraction on the sensitizers.

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The sensitizers used in the present invention are benzoylaminanthraquinones and phthaloylaminanthraquinones, particularly suitable compounds of this kind being:

15      (I) 1 - benzoylaminanthraquinone  
           (II) 1,4 - dibenzoylaminanthraquinone  
           (III) 4,8 - dibenzoylaminanthraquinone  
           (IV) N,N' - di - (1 - anthraquinonyl) - isophthalic acid diamide.

20      These materials have the following formulae:



25      The substances used as sensitizers in the present invention are well known and are commercially available from dye manufacturers. They may be used individually or in the form of mixtures of two or more individual components.

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The manufacture of the thermoplastics moulding compositions of the invention from the above components may be effected in a simple manner such as is normally employed for the incorporation of additives in the said thermoplastics to give a substantially homogeneous mixture, for example by milling or extrusion.

Processing of said moulding compositions into shaped articles may also be readily effected using the apparatus normally employed for said thermoplastics.

The moulding compositions are primarily intended for the manufacture of articles which are intended to decompose rapidly under the action of light. These are mainly products intended for use as packaging materials, for example boxes and sheeting of foamed or unfoamed moulding compositions. However, they are also suitable for other types of product, for example mulching sheets for horticultural and agricultural purposes.

**Example 1**  
 100 parts by weight of a commercial polyethylene (density 0.918 g/cm<sup>3</sup>) containing no photo-active additives are homogeneously mixed with 1.5 parts by weight of 1 - benzoylaminanthraquinone in a Welding extruder at 240°C.

Sheeting have a thickness of 100  $\mu$  made from this moulding composition shows degradation under the action of light at a rate which is approximately 3.5 times faster than that shown by sheeting having the same thickness but made from the unsensitized moulding composition, when subjected to similar conditions.

**Example 2**  
 100 parts by weight of a commercial polyethylene (density 0.952 g/cm<sup>3</sup>) containing no photo-active additives are homogeneously mixed with 0.2 part of 4,8 - dibenzoylaminanthraquinone in a Welding extruder at 260°C.

Sheeting having a thickness of 100  $\mu$  made from this moulding composition shows degradation under the action of light at a rate which is approximately 5 times greater than that shown by sheeting of the same thickness but made from the unsensitized moulding composition, when subjected to similar conditions.

**Example 3**  
 100 parts by weight of a commercial polypropylene containing no photo-active additives are homogeneously mixed with 0.5 part by weight of N,N' - di - (1 - anthraquinonyl) - isophthalic diamide in a Buss Ko-Kneader at 210°C.

Sheeting having a thickness of 100  $\mu$  made from this moulding composition shows degradation under the action of light at a rate which is approximately 3.5 times greater than that shown by sheeting of the same thickness but made from the unsensitized moulding composition, when subjected to similar conditions.

**Example 4**  
 100 parts by weight of a commercial

polystyrene (impact resistant type) containing no photo-active additives are homogeneously mixed with 0.4 part by weight of 1,4 - dibenzoylaminooanthraquinone in a ZSK 5 extruder at 220°C.

Sheeting having a thickness of 200  $\mu$  made from this moulding composition shows degradation under the action of light at a rate which is approximately 3.7 times faster than 10 that shown by sheeting of the same thickness but made from the unsensitizing moulding composition, when subjected to similar conditions.

**WHAT WE CLAIM IS:—**

15 1. A thermoplastic moulding composition showing accelerated degradation under the action of light and comprising (1) a synthetic organic thermoplastic high molecular weight polymeric material (thermoplastic) and (2) a substance (sensitizer) which accelerates the degradation of said thermoplastic under the action of light, which sensitizer is present in an amount of from 0.01 to 5%, based on the thermoplastic, wherein said moulding 20 compositions contain, as sensitizer, a benzoyl-aminoanthraquinone or a phthaloylaminooanthraquinone.

25 2. A composition as claimed in claim 1 wherein the sensitizer is 1 - benzoylaminooanthraquinone, 1,4 - dibenzoylaminooanthraquinone, 4,8 - dibenzoylaminooanthraquinone.

30 3. A composition as claimed in claim 1 or N,N' - di - (1 - anthroquinonyl) - isophthalic acid diamide.

3. A composition as claimed in claim 1 or 2 wherein the sensitizer is present in an amount from 0.1 to 2% by weight based on the thermoplastic.

4. A composition as claimed in any of claims 1 to 3, wherein the thermoplastic is a homopolymer or copolymer containing ethylene, propylene, butene-1, 4-methylpentene-1 and/or styrene as the sole or main monomer.

5. A moulding composition showing accelerated degradation under the action of light as claimed in claim 1 and substantially as hereinbefore described or exemplified.

6. A method of manufacturing a thermoplastic composition showing accelerated degradation under the action of light, which comprises incorporating into a synthetic organic thermoplastic high molecular weight polymeric material in an amount of from 0.01 to 5% by weight thereof of benzoylaminooanthraquinone or a phthaloylaminooanthraquinone, so as to form a homogeneous mixture, and processing the mixture to form a finished product.

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